A systematic review examining the characteristics of users of NHS patient medicines helpline services, and the types of enquiries they make.

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Abstract

Background and objective: Patient medicines helpline services (PMHS) are available from some National Health Service Trusts in the United Kingdom to support patients following discharge. The aim of this systematic review was to examine the available evidence regarding the characteristics of enquirers and enquiries to PMHS, in order to develop recommendations for service improvement.

Methods: Searches were conducted using Medline, EMBASE, CINAHL, Scopus, and Web of Science, on 4th June 2019. Forward and backward citation searches were conducted, and grey literature was searched. Studies were included if they reported any characteristics of enquirers who use PMHS, and/or enquiries received. Study quality was assessed using the AXIS tool. A narrative synthesis was conducted, and where appropriate, weighted means (WM) were calculated. Where possible, outcomes were compared to Hospital Episode Statistics (HES) data for England, to establish whether the profile of helpline users may differ to that of hospital patients.

Results: Nineteen studies were included (~ 4423 enquiries). Risk of bias from assessed studies was 71%. Enquirers were predominantly female (WM = 53%; HES mean = 57%), elderly (WM = 69 years; HES mean = 53 years), and enquired regarding themselves (WM = 72%). Out of inpatient and outpatient enquirers, 50% were inpatients and 50% were outpatients (WM). Six of fourteen studies reported adverse effects as the main enquiry reason. Two of four studies reported antimicrobial drugs as the main enquiry drug class. From two studies, the main clinical origin of enquiries were general surgery and cardiology. Across six studies, 27% (WM) of enquiries concerned medicines-related errors.

Conclusions: Our findings show that PMHS are often used by elderly patients, which is important since this group may be particularly vulnerable to experiencing medicines-related issues following hospital discharge. Over a quarter of enquiries to PMHS may concern medicines-related errors, suggesting that addressing such errors is an important function of this service. However, our study

findings may be limited by a high risk of bias within included studies. Further research could provide a more detailed profile of helpline users (e.g., ethnicity, average number of medicines consumed), and we encourage helpline providers to use their enquiry data to conduct local projects to improve hospital services (e.g., reducing errors).

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Keywords: systematic review, patient medicines helplines, National Health Service, medicines information, drug information, hospital pharmacy.

BACKGROUND

Approximately 40% of patients who have been discharged from hospital may experience medicines-related problems [1, 2]. Additionally, patients often lack knowledge about their medications following hospital discharge [3, 4], and many patients report not receiving important medicines-related information [5, 6]. Patients may also experience medicines-related errors following hospital discharge, such as dispensing errors and incorrect or missing information on discharge documents [7, 8]. Hospital discharge may therefore be a confusing and/or risky period for patients who have recently experienced changes to their medicines.

Consequently, in the UK, hospital-based patient medicines helpline services (PMHS) have become available from some NHS Trusts. The first PMHS was established in the UK in 1992 [9], and a survey study conducted in 2017 found that 52% of NHS Trusts provided a PMHS [10]. The function of a PMHS is to enable discharged patients to seek medicines-related support from pharmacy professionals from the healthcare setting where they recently received care. This accords with World Health Organisation (WHO) policy, which states that offering information on medicines via Medicines Information (MI) centres, and providing public education about medicines, are two of twelve essential interventions to promote the rational use of medicines [11].

Studies that have examined PMHS have typically been service evaluations of individual sites to describe the characteristics of enquirers and their enquiries, and to report the effectiveness of PMHS using enquirer satisfaction surveys (e.g., [12, 13]). A recent systematic review examined the evidence regarding the effectiveness of PMHS, concluding that they are typically perceived as positive, advice is usually followed, and users report several positive outcomes (e.g., problems resolved/avoided, and improved health) [14]. However, to date, a review of the literature has not been conducted which brings together the available evidence regarding the characteristics of enquirers to PMHS, nor the enquiries they make. The findings of such a review would be more generalisable to PMHS throughout the UK than individual service evaluations. Such information

could be useful for establishing whether PMHS are under-used by any types of patients, and for understanding patients' needs, which could highlight areas for service improvement.

Aim

The aim of this systematic review was to address the following research questions, in order to develop recommendations for improving PMHS, and potentially, hospital pharmacy services more widely: *What are the characteristics of people who use PMHS? What are the characteristics of enquiries made to PMHS?*

METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses were used in the planning, conducting, and reporting of this review. The protocol was registered with the International Prospective Register of Systematic Reviews on 21st November 2018 (registration number CRD42018116276) [15].

Eligibility criteria

Studies were included if they reported any characteristics of enquirers who use PMHS, and/or enquiries received. PMHS were defined as: (1) a service for patients and/or carers of patients who received care from the NHS Trust within the UK that provides the PMHS, and not for a specific subset of patients and/or their carers; (2) a service involving distance communication, via any means, between the service user and service provider, instigated by the service user; and (3) a service providing MI, and not general clinical information.

We included published and unpublished studies, abstracts, and conference proceedings that were written in English. We excluded studies if the data were presented in a subsequently published format (e.g., a study in a conference proceeding if it was subsequently published as a full-text article). No restriction was made regarding year of publication.

Studies were only included where the types of enquirers and/or enquiries were based upon either the total number of all enquiries received within a specified period (e.g., six months), or a randomly selected number of enquiries from all enquiries received within a specified period. Studies were excluded if they solely described a subset of all enquirers or enquiries (e.g., only female enquirers, or enquiries about adverse effects), since the focus was upon PMHS, and not upon specific patient groups, issues, or conditions.

Search strategy

Searches were conducted using Medline, EMBASE, CINAHL, Scopus, and Web of Science. Where possible, searches were conducted using both free-text and subject headings. The search strategy was determined for EMBASE, and subsequently adapted to the syntax and subject headings of the other databases (see *Supplementary Information 1* for the EMBASE search strategy). Searches were conducted on 1st August 2017 and updated on 4th June 2019. Forward and backward citation searches were conducted for all included studies. Forward citation searches were conducted on 4th June 2019, using Scopus, Web of Science, and Google Scholar.

The following grey literature sources were searched: grey literature databases, Google and Google Scholar, conferences proceedings, and consultation with experts (see *Supplementary Information 2* for further details).

Screening and selection of studies

Database search results were exported to Covidence [16], duplicates were removed, and studies were screened and selected. Two researchers independently screened all titles and abstracts for relevance, and disagreements were resolved by discussion. Articles meeting the inclusion criteria, or where there was uncertainty, were obtained in complete form. Full text reports were independently examined against the inclusion criteria by two researchers, and disagreements were resolved by discussion.

Data extraction

Data extraction was conducted by one researcher using a data extraction form, with 20% verified by another researcher (see *Supplementary Information 3* for the data extraction form). No discrepancies were found. Details from all data extraction forms were entered in to an excel spreadsheet, in preparation for analysis.

Raw data were not analysed for this systematic review. However, where there was the potential to attain data in a more relevant format, authors of studies were contacted (e.g., to ask if they would be willing to provide the mean age of enquirers from their retrospective review of enquiries).

Quality assessment of included studies

The AXIS tool [17] was chosen to assess risk of bias and quality within studies. This tool comprises 20 items for assessing cross-sectional studies, and is composed of three subscales. The subscales measure risk of bias (i.e., selection bias, measurement bias, non-response bias, and reporting bias; e.g., 'Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?'), quality of reporting (e.g., 'Were the methods (including statistical methods) sufficiently described to enable them to be repeated?'), and quality of study design (e.g., 'Was the study design appropriate for the stated aim(s)?'). The assessment of risk of bias and quality were used for information, and not to exclude studies. Each included study, for which there was a full report, was independently appraised by two researchers. Only full reports were appraised, since they contained enough information to adequately assess risk of bias and quality of reporting compared to, for example, conference abstracts. Disagreements were resolved through discussion.

Narrative synthesis

Findings were synthesised in a narrative synthesis around the study objectives, following the guidelines by Popay et al. [18]. Where possible, weighted averages were calculated across studies to account for varying sample sizes. Additionally, where possible, outcomes were compared to Hospital Episode Statistics (HES) admitted patient care and outpatient data for England, to examine the representativeness of PMHS enquirers. Since the years of data collection varied across studies, the average of HES data for the past five years were used (2013-14 to 2017-18; [19]).

RESULTS

Study selection

Nineteen studies were identified for inclusion in this review. Figure 1 shows a flow diagram of the study selection process.

Study characteristics

Included studies are presented in Table 1. Eight studies contained data regarding the characteristics of enquirers of PMHS. Eighteen studies contained data regarding the types of enquiries made to PMHS. All studies were retrospective reviews of enquirers and/or enquiries.

Table 1. Studies meeting eligibility criteria for the systematic review of the characteristics of enquirers and enquiries to patient medicines helpline services.

First author, Year published	Study source	Study design	Country of study	Data collection year/s (weeks/months) [a]	Number of enquiries	Outcomes	
						Enquirers	Enquiries
Adam, 2004 [20]	CA	RRE	England	2003 (1 week)	90	X	X
Badiani, 2017 [13]	PS-PR	RRE	England	2015 (9 months)	637		X
Bramley, 2014 [12]	PS-PR	RRE	United Kingdom	2009 (12 months)	312	X	X
Bruce, 1995 [21]	PS-BR	RRE	Scotland	1994-1995 (12 months)	111		X
Burgess, 2009 [22]	CA	RRE	England	2008 (1 month)	17	X	
Cooke, 2010 [23]	CA	RRE	England	2009-2010 (NR)	56		X
Cuthbert, 2013 [24]	CA	RRE	Scotland	NR (6 weeks)	18	X	X
Dhillon, 2001 [25]	PS-PR	RRE	England	NR (3 months)	109	X	X
Dugdale, 2018 [26]	CA	RRE	England	2016-2017 (24 months)	538		X
Hynes, 2013 [27]	CA	RRE	England	2011-2012 (12 months)	209		X
Jones, 2014 [28]	CA	RRE	England	2012-2014 (NR)	234		X
Law, 2015 [29]	CA	RRE	England	2015 (4 months)	109		X
Martin, 2014 [30]	LE	RRE	Wales	2012-2013 (12 months)	262	X	X
Marvin, 2011 [31]	PS-PR	RRE	England	2008 (6 months)	500		X
Price, 2011 [32]	CA	RRE	England	2010-2011 (NR)	51		X
Raynor, 1994 [9]	PS-BR	RRE	England	NR (NR)	NR		X
Sims, 1996 [33]	CA	RRE	England	NR (NR)	> 1000 [b]		X
Teli, 2001 [34]	CA	RRE	England	1999 (NR)	NR	X	X
Williams, 1994 [35]	PS-PR	RRE	England	1993 (NR)	170	X	X

Note. Abbreviations: CA = conference abstract; LE = letter to the editor; NR = not reported; PS-BR = study published as a brief report; PS-PR = published study in a peer reviewed journal; RRE = retrospective review of enquiries.

[a] Of the included studies, the data collection period ranged from one week to twelve months (mean = approximately 31 weeks; seven studies did not report the data collection period length).

[b] This study reported their sample size as 'over 1000'.

Quality assessment and risk of bias within studies

Five studies met our criteria for quality and risk of bias assessment. The overall score and percentage of quality and risk of bias for these studies are presented in Table 2. Fleiss Kappa was conducted, showing that there was substantial agreement between raters [36], K = .72 (95% CI, .56 to .88), p = .000.

Table 2. Quality assessment and risk of bias in full reports of studies meeting eligibility criteria for the systematic review.

First author, Year published	Total [a]	RoB [b]	QoR	QoSD
Badiani, 2017 [13]	50% (10/20)	50% (3/6)	57% (4/7)	43% (3/7)
Bramley, 2014 [12]	63% (12/19)	40% (2/5)	71% (5/7)	57% (4/7)
Dhillon, 2001 [25]	29% (5/17)	100% (3/3)	14% (1/7)	57% (4/7)
Marvin, 2011 [31]	65% (11/17)	67% (2/3)	71% (5/7)	71% (5/7)
Williams, 1994 [35]	35% (6/17)	100% (3/3)	43% (3/7)	43% (3/7)
Average (mean) percentage	48%	71%	51%	54%

Note. Abbreviations: QoR = quality of reporting score (out of a maximum score of 7); QoSD = quality of study design score (out of a maximum score of 7); RoB = risk of bias score (out of a maximum score of 6).

[a] Quality assessment was measured using the AXIS tool, developed by Downes et al. (2016). Depending on the study design, not all RoB items were relevant (i.e., three RoB items pertain to non-response bias, and three of the studies did not recruit study participants since their aim was to only assess PMHS enquiries. Additionally, the study by Bramley (2014) recruited study participants with no non-responders, thus rendering one item obsolete). This accounts for the different maximum Total scores and RoB scores across studies.

[b] The *Risk of Bias* items were reversed, so that the reported percentages reflect the amount of potential bias in each study. However, the AXIS total score was calculated without reversing the *Risk of Bias* items, to ensure that the reported total score percentages reflect the amount of positively coded items in the tool. This accounts for the discrepancy between the total score and the sum of the subscales for each study.

Characteristics of enquirers

Table 3 presents eight studies that reported data regarding the characteristics of enquirers. Enquirers are predominantly female, elderly, and enquiring for themselves.

Table 3. Characteristics of enquirers who use patient medicines helpline services

First author, Year published	*N*	Mean age	% female	% enquired for self	% repeat callers	% discharged inpatients	% outpatients
Adam, 2004 [20]	90	—	62%	—	—	—	—
Bramley, 2014 [12]	312	—	50%	70%	—	—	—
Burgess, 2009 [22]	17	—	—	76%	—	40% [c]	60% [c]
Cuthbert, 2013 [24]	18	70 (SD = 15)	61%	56%	—	—	—
Dhillon, 2011 [25]	109	—	63%	64%	15%	—	—
Martin, 2014 [30]	262	69 (SD = NK)	50%	79%	—	51% [d]	49% [d]
Teli, 2001 [34]	NR	—	—	—	—	72%	18%
Williams, 1994 [35]	170	—	—	—	4%	—	—
Average (mean)		70	57%	69%	10%	54%	42%
Weighted average (mean)		69	53%	72%	8%	50% [e]	50% [e]
HES data, where available		53 [a]	57% [b]	—	—	18%	82%

Note. Abbreviations: HES = Hospital episode Statistics; NK = not known; NR = not reported. Part of the data for the studies by Cuthbert et al. and Martin et al. was obtained from the authors via personal communication.

[a] Range of mean ages over five years of HES data = 52 years to 54 years. Only HES admitted patient care data were used, since mean age was not reported in HES outpatient datasets.

[b] Range of percentages over five years of HES data = 57% to 58%

[c] In the study by Burgess, 2009, two service users were members of the public. Therefore, in order to only use the data regarding inpatients and outpatients, we calculated the percentages of discharged inpatients and outpatients using only the total number of callers who were discharged inpatients or outpatients (*n* = 15).

[d] In the study by Martin, 2014, 21% of service users were reported as being from ophthalmological surgery or clinics, and 22% were not reported. Therefore, in order to only use the data regarding inpatients and outpatients, we calculated the percentages of discharged inpatients and outpatients using only the total number of callers who were discharged inpatients or outpatients (*n* = 149).

[e] The weighted averages for percentages of discharged inpatients and percentages of discharged outpatients are based upon two of three studies, since the sample size was not reported in the study by Teli, 2001.

Types of enquiries

Contact reason

Table 4 presents the findings from fifteen studies that reported reasons for contacting a PMHS. Adverse effects was the category reported as the primary reason for enquiries from six of the fifteen studies, with a weighted mean of 37% of all enquiries.

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Table 4. Reason for enquiries reported in studies examining patient medicines helpline services.

Enquiry category	Numbers and percentages of studies reporting the specified category as the primary reason for enquiries		
	Total (*N* = 15)	Range of reported percentages of enquiries (mean; WM)	Sample size range (Total *n*)
Adverse effects	6 [9, 20, 27, 34, 35, 37]	21% - 46% (33%; 37%)	56 - 209 (at least 525[a])
Administration or dosage	5 [21, 26, 29, 30, 32]	21% - 52% (37%; 34%)	49 - 538 (1058)
Interactions	1 [31]	22%	500
Appropriateness or safety of medicines	1 [13]	50%	637
Indications, efficacy or mechanisms of action	1 [33]	34%	At least 1000 [b]
Insufficient information on hospital discharge letter	1 [12]	24%	413

Note. Abbreviations: WM = weighted mean (weighted by sample size). Enquiry categories are listed according to the number of studies within each category. There may be overlap between some enquiry categories, since study authors did not use exactly the same categories.

[a] Two of the six studies did not report their sample size.

[b] This study reported their sample size as 'over 1000'.

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Clinical origin of enquiry

Two studies reported the clinical origin of enquiries to their PMHS. For Price et al., [32] the top three clinical origin of enquiries were Surgery (59%), General Medicine (13%), and Paediatrics (6%). For Bramley et al., [12] the top three clinical origin of enquiries were Cardiology (20%), General Medicine (8%), and Ear, Nose and Throat (6%).

Drug classes

Four studies reported the percentage of enquiries by drug class. The largest drug class was reported to be antimicrobial drugs by two studies (19% and 21% of all enquiries) [25, 31] and cardiovascular drugs in a third study (27% of all enquiries) [35]. The fourth study, which took place at a mental health Trust, reported atypical antipsychotics as the main drug class (38% of all enquiries) [27].

Enquiries regarding medicines-related errors

Table 5 presents six studies that reported the percentage of enquiries that were regarding medication errors [12, 13, 24, 28, 29, 31]. Combined, the studies suggest that between 8% and 39% of enquiries concern errors (mean = 31%; weighted mean = 27%).

Table 5. Studies examining the number of enquiries received by patient medicines helpline services that were regarding medicines-related errors.

Author, Year published	*N*	Total percentage of enquiries regarding errors	Primary error type
Bramley, 2014 [12]	312	8%	Missing medicines (38%)
Badiani, 2017 [13]	637	39%	Transfer of care errors (69%)
Cuthbert, 2013 [24]	18	33%	NR
Jones, 2014 [28]	NR	19%	NR
Law, 2015 [29]	109	20%	NR
Marvin, 2011 [31]	500	34%	Wrong/insufficient information supplied with medicine (49%)

Note. NR = not reported. There may be overlap between some error type categories, since study authors did not use exactly the same categories.

DISCUSSION

This systematic review synthesised the current evidence regarding the characteristics of enquirers to PMHS, and the types of enquiries they make. Included studies were all service evaluations where authors evaluated their own service, and we found the averagerisk of bias in study articles to be 71%, which we perceive to be high.

Characteristics of enquirers

Our findings suggest that users of PMHS are broadly representative of hospital patients regarding gender, but not age. The average age of helpline enquirers was 69 years, compared to an average age of 53 years for hospital patients. This could reflect that older people tend to seek health information from healthcare professionals directly, compared to younger people who may be more inclined to seek information online [38, 39].

The age difference may also suggest that PMHS are particularly valued as a source of support by people who are at heightened risk with their medicines, since there is an association between age and polypharmacy [40]. Research suggests that polypharmacy increases the risk of prescribing errors [41], adverse drug reactions [42], drug-drug interactions [40], suboptimal adherence [43], emergency department visits [44], unplanned hospital admissions [45], and readmissions [46]. Polypharmacy also increases the likelihood that patients will lack knowledge or understanding of their medicines [47]. Although no data were found as to the average number of prescribed medicines consumed at the time of contacting a PMHS, approximately 22% of enquiries to PMHS in the UK are regarding interactions, suggesting that a number of enquirers are consuming more than one medicine.

Population projections produced by the Office for National Statistics suggests that there will be a significant increase in the population of older people in the next two decades [48]. This may

indicate an increased need for MI services in the future, in order to provide support to this growing population.

Our findings, in the context of previous evidence, suggest that there are a number of individuals who may be denied access to some PMHS. We found that 28% of users contacted the service on behalf of a patient, and that 50% of enquiries to PMHS may be from outpatients compared to discharged inpatients. A recently conducted survey of PMHS in England reported that 7% of PMHS (eight NHS Trusts) do not provide advice to carers, and that 5% of PMHS do not provide the service to outpatients [10]. This suggests that a proportion of individuals in need of medicines-related support are not able to access it from these particular PMHS. This is important, since one study found that approximately 48% of 500 answered enquiries to a PMHS were considered to have the potential to prevent harm from medicines [31]. This highlights the need to advertise this service, and make it available, to *all* patients who may benefit from using it.

Our systematic review found no studies that reported the ethnicity nor educational level/socioeconomic status of enquirers, nor the average number of medicines consumed. Additionally, of the eight studies that reported data regarding the characteristics of enquirers, none of the data were collected within the past five years, suggesting that the relevance and generalisability of the data are now questionable.

Types of enquiries

Our findings suggest that there is wide variation in the percentages of types of enquiries received to different PMHS, since six different categories were reported as being the primary reason for enquiries. This highlights the importance of conducting locally tailored improvement projects whereby PMHS data for an NHS Trust are used to produce recommendations to improve their own services. However, this variation may also be a consequence of sites coding their enquiries using

unstandardised enquiry category options, and/or possible confusion regarding how to code certain enquiries (e.g., those that may fit more than one category).

In six of fifteen studies that reported reasons for contacting a PMHS, the largest category of enquiries to PMHS concerned adverse effects. These findings are congruent with the results from the UK National Health Service (NHS) annual Adult Inpatient Survey found that, between 2013-2017, 42-44% of patients (*n* range = 38384-52554) did not recall receiving any information from staff about side effects [6]. Consequently, by improving medicines-related counselling to patients at hospital discharge, particularly around side effects, patients may be less likely to need support following discharge [49]. However, there is always likely to be a need for PMHS to support patients and carers following patients' discharge from hospital. Evidence suggests that some patients, particularly the elderly, may forget or misunderstand aspects of discharge counselling pertaining to their medicines [3, 50, 51]. Additionally, it could be that even if patients are provided with information about potential side effects at the time of discharge, they may still require support later on, at the time when side effects develop.

One proposed benefit of PMHS is that they act as a safety net to identify errors [10]. Our synthesis suggests that up to 39% of enquiries to PMHS are regarding medicines-related errors, with a weighted mean of 27%. Medication errors can have significant health and economic consequences, such as adverse drug reactions, reduced medication efficacy, increased use of healthcare services, and death [52]. Learning from medicines-related errors in order to implement methods for their reduction is a current NHS and worldwide healthcare priority [52]. Royal Pharmaceutical Society-endorsed national standards for operating a PMHS are available [53], one of which is having a mechanism in place to feed back to the Trust medication problems and 'systems errors' identified by patients/carers in order to prevent recurrence. Therefore, a PMHS may provide one avenue for reducing medicines-related errors, if the information from such enquiries is developed into recommendations and implemented in order to improve practice. However, it is currently unknown

what percentage of Trusts currently adhere to this standard, and whether there are specific barriers preventing this from happening.

Recommendations

Further research is needed to establish patients' MI needs and preferences, including those of younger patients. Our findings indicate that enquiries to PMHS are often from elderly patients, and cross-sectional studies suggest that younger people are more likely to seek health-related information online compared to older people [39]. However, depending on the source, online information about medicines may not be as reliable as seeking the advice of a pharmacy professional with expertise in MI. Therefore, one way to improve the reach of PMHS may be to establish electronic means to access them, which may be more appealing to younger patients. However, it would be advantageous to first establish the medicines-related needs of younger patients, and how best to engage with them to increase their awareness and use of PMHS.

We recommend that PMHS sites conduct service evaluations in order to provide a more detailed and standardised profile of enquirers (e.g., including ethnicity, educational level/socioeconomic status, and the average number of medicines consumed by patient enquirers). This would help to establish how enquirers compare to the local patient population, and to enable comparisons across sites. Such data could be useful to explore whether certain types of patients are less likely to use the service. This could result in projects to understand why, and whether more can be done to provide a service that is equitable and available for *all* hospital patients who require support with their medicines.

We encourage providers of PMHS to evaluate the types of enquiries they receive (including whether they pertain to a medicine error) by using nationally standardised categories and coding instructions/training materials that are endorsed by the UK Medicines Information network (UKMi). This will enable the types of enquiries received to be more appropriately compared across sites and regions within the UK.

We also encourage sites to use data on types of enquiries to PMHS to produce recommendations for improving local hospital services. For example, six studies reported that enquiries were predominantly about adverse effects, and two studies reported that enquiries were predominantly about antimicrobial drugs. Therefore, potential projects could involve improving patient leaflets and counselling regarding adverse effects and antimicrobial drugs. Another example could be for sites to monitor the number of enquiries regarding medication errors to establish whether using helpline data to improve practice within the hospital results in a reduced number of calls about errors over time. It would also be useful if sites were more easily able to share learning from their local projects, for example, having the capability to share brief reports via the UKMi network.

Strengths and limitations

This is the first systematic review that has examined the types of enquirers and enquiries of PMHS. This has resulted in our development of recommendations to improve current practice in the operation and evaluation of PMHS, and potentially hospital pharmacy services more widely.

However, the findings of this review may be limited by the small number of studies available to establish averages for certain enquirer characteristics. For example, our findings regarding the average age of participants, the average percentage of repeat enquirers, and the weighted average percentage of inpatients versus outpatients, are all based upon two studies each. Therefore, these findings should be treated with caution, and also emphasise the need for additional, larger studies to examine the profile of enquirers to PMHS.

Relatedly, the findings of this review may also be limited due to the potential lack of high-quality studies currently available. Only five of the nineteen studies in this review met our eligibility criteria for the assessment of quality and risk of bias, since most studies were from conference abstracts and their content was considered too limited to perform a thorough quality assessment

upon. We considered the quality of these five studies to be moderate (on average, 48%; range = 29%-65%) and their risk of bias to be high (on average, 71%; range =40%-100%). Therefore, a limitation of this review is that our quality assessment and risk of bias average scores are only based upon 26% of the studies included in this review. However, since the remaining 74% of studies comprised conference abstracts, brief reports, and a letter to an editor, their lack of peer review may arguably raise concern over their quality, also.

Another limitation of this review concerns our comparison of PMHS findings to HES data, since the HES data used in this study is not specifically regarding patients that consume medicines. Also, the HES average age percentage (53%) was calculated from HES admitted patient care data only, since mean age was not reported in HES outpatient datasets. Therefore, the HES age percentage used in this study may not be fully representative of the types of patients who may use a PMHS. Additionally, we compared the findings of this review with HES data over the past five years. Therefore, the data collection years for the studies included in this review and for the HES data did not correspond, which will likely affect the comparison. However, the HES data used were relatively stable over the five years.

Finally, we did not contact all sites that provide a PMHS in the UK to establish whether any local unpublished work could be included in this review. Instead, we contacted authors of included studies within the past ten years to establish the availability of unpublished work from their sites. Therefore, it is possible that other studies may have been conducted with findings that are relevant to this review, but which were not included.

Conclusions

This systematic review synthesised evidence regarding the users of PMHS and the enquiries they make. The service seems particularly appealing for patients who are vulnerable to experiencing medicines-related issues following hospital discharge, since PMHS are often used by the elderly, and

elderly patients are more likely to experience polypharmacy. Additionally, over a quarter of enquiries to PMHS may concern medicines-related errors, suggesting that addressing such errors is an important function of this service. However, our study findings may be limited by a high risk of bias within included studies. Further research could provide a more detailed profile of helpline users (e.g., ethnicity, average number of medicines consumed). We recommend standardising the way that PMHS data are categorised and reported so that data are more easily comparable and collated across sites for a more generalisable picture of PMHS use. We encourage PMHS providers to use routinely collected data to conduct local quality improvement projects (e.g., to reduce medicines-related errors, and improve patient MI leaflets/counselling), and to share project findings with other PMHS providers.

LIST OF ABBREVIATIONS

MI = medicines information; NHS = National Health Service; PMHS = patient medicines helpline service; UK = United Kingdom; UKMi = United Kingdom Medicines Information Network.

DECLARATIONS

Ethics approval and consent to participate

Not applicable, since the research used secondary data sources collected from published and unpublished studies.

Consent for publication

Not applicable.

Availability of data and material

Not applicable, since no primary data were collected or used for this research.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The study was designed by MW and MJ, with advice from AJ and JS. MW was involved in all stages of the systematic review process, and drafted the manuscript. MJ, AJ and JS were involved in the screening of titles and abstracts. MJ was involved in discussions regarding the inclusion of studies and the quality assessment of studies. All authors read, provided feedback and approved the final manuscript.

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SUPPLEMENTARY INFORMATION

Supplementary Information 1. Search strategy for EMBASE.

Supplementary Information 2. Grey literature sources searched.

Supplementary Information 3. Data extraction form.

FIGURE LEGENDS

Figure 1. Flow diagram of the study selection process

[a] Forward and backward citation searches, grey literature databases, Google and Google Scholar, targeted websites/sources, and consultation with experts.

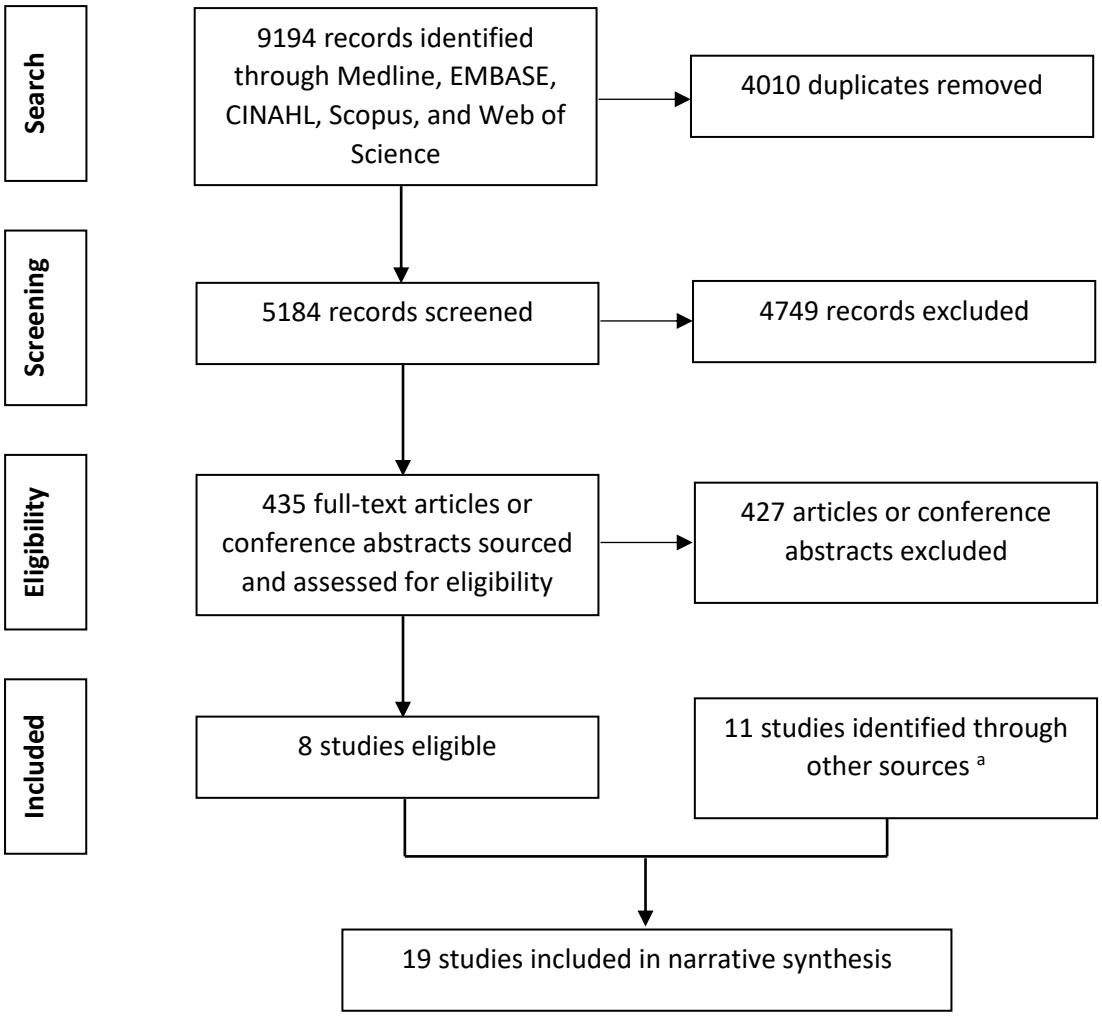

Figure 1. Flow diagram of the study selection process

[a] Forward and backward citation searches, grey literature databases (OpenGrey and ProQuest database for dissertations and theses), Google and Google Scholar, targeted websites/sources, and consultation with experts.

A systematic review examining the characteristics of users of NHS patient medicines helpline services, and the types of enquiries they make

Supplementary Information 1. Search strategy for EMBASE

#1 'hotline'/exp AND ([embase]/lim OR [embase classic]/lim)

#2 hotline*:ti,ab OR 'hot$line*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#3 helpline*:ti,ab OR 'help$line*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#4 'telephone'/exp AND ([embase]/lim OR [embase classic]/lim)

#5 telephone*:ti,ab OR phone*:ti,ab AND ([embase]/lim OR [embase classic]/lim)

#6 'e-mail'/exp AND ([embase]/lim OR [embase classic]/lim)

#7 email*:ti,ab OR 'e-mail*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#8 'internet'/exp AND ([embase]/lim OR [embase classic]/lim)

#9 'internet*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#10 online:ti,ab AND ([embase]/lim OR [embase classic]/lim)

#11 webform*:ti,ab OR 'web$form*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#12 webpage*:ti,ab OR 'web$page*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#13 website*:ti,ab OR 'web$site*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#14 'web$based':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#15 'mobile application'/exp AND ([embase]/lim OR [embase classic]/lim)

#16 (((mobile NEXT/2 app):ti,ab) OR ((mobile NEXT/2 apps):ti,ab) OR ((mobile NEXT/2 application*):ti,ab)) AND ([embase]/lim OR [embase classic]/lim)

#17 'mobile device*':ti,ab AND ([embase]/lim OR [embase classic]/lim)

#18 ('social network*' OR twitter OR tweet* OR facebook OR 'instant messag*' OR 'SMS'):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#19 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18

#20 'pharmacy'/exp AND ([embase]/lim OR [embase classic]/lim)

#21 'clinical pharmacy'/exp AND ([embase]/lim OR [embase classic]/lim)

#22 'hospital pharmacy'/exp AND ([embase]/lim OR [embase classic]/lim)

#23 'pharmacy school'/exp AND ([embase]/lim OR [embase classic]/lim)

#24 (pharmacy:ti,ab OR pharmacies:ti,ab) AND ([embase]/lim OR [embase classic]/lim)

#25 'pharmacist'/exp AND ([embase]/lim OR [embase classic]/lim)

#26 'pharmacy technician'/exp AND ([embase]/lim OR [embase classic]/lim)

#27 pharmacist*:ti,ab AND ([embase]/lim OR [embase classic]/lim)

#28 #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27

#29 ((drug* OR medicine* OR medication*) NEAR/5 (information OR advice OR support OR enquir* OR inquir*)):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#30 #19 AND #28 AND #29

#31 (telepharmac*:ti,ab OR 'tele$pharmac*':ti,ab) AND ([embase]/lim OR [embase classic]/lim)

#32 ('epharmac*':ti,ab OR 'e$pharmac*':ti,ab) AND ([embase]/lim OR [embase classic]/lim)

#33 ((drug* OR medicine* OR medication*) NEAR/5 (hotline* OR hot$line*)):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#34 ((drug* OR medicine* OR medication*) NEAR/5 (helpline* OR help$line)):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#35 ((drug* OR medicine* OR medication*) NEAR/5 'call cent*'):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#36 ((drug* OR medicine* OR medication*) NEAR/5 'information cent*'):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#37 ((drug* OR medicine* OR medication*) NEAR/5 'information service*'):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#38 ((drug* OR medicine* OR medication*) NEAR/5 'information line*'):ti,ab AND ([embase]/lim OR [embase classic]/lim)

#39 #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38

Supplementary Information 2. Grey literature search strategy

Godin et al. recommend applying a systematic approach when searching for grey literature [1]. Following their recommendations, four grey literature sources were searched:

1) *Grey literature databases*. OpenGrey and ProQuest database for dissertations and theses were searched using the following search terms: 'medicines information', 'medicines helpline', 'drug information', and 'drug helpline'.

2) *Google and Google Scholar*. The Google search involved evaluating the relevance of all available hits when searching for the exact terms 'patient medicines helpline', 'medicines information centre', 'drug information helpline', 'drug information center', and 'drug information service'. The Google Scholar search involved evaluating the relevance of all available hits when searching for the exact terms 'patient medicines helpline', 'medicines information centre' , 'drug information helpline', 'drug information center', and 'drug information service', and then repeating the searches when limiting the terms to appearing in the title only. Limiting the search to 'title only' was recommended by Haddaway et al. [2], who conducted an evaluation using Google Scholar to search for grey literature in seven published systematic reviews.

3) *Targeted websites/sources*. Proceedings from the following UK conferences were searched: UK Medicines Information Practice Development Seminar (1995-2017), Royal Pharmaceutical Society Conference (formerly called British Pharmaceutical Conference; 1992-2017), Health Services Research and Pharmacy Practice Conference (1995-2018), and International Social Pharmacy Workshop (2004-2018).

4) *Consultation with experts*. The main author of all included studies that were published within the last ten years were contacted, requesting details of any similar research already completed or being carried out, providing that a report of the findings was drafted.

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Data extraction form

Source of study:

Title:

Author:

Year published:

Year of data collection:

Study design/s:

Type of service (i.e., is it a PMHS?):

Number of participants/enquiries:

Outcomes:

Details of analysis:

Additional comments: